RHINO EQUIPMENT CORP.

Rhino® Open Source Telephony PCI and PCI Express Cards for Linux

User Manual

Models:

T1/E1 Models:

- **R1T1, R1T1-e:** Single port T1 PCI card
- **R2T1, R2T1-e:** Dual port T1 PCI card
- **R4T1, R4T1-e:** Quad port T1 PCI card

Fixed Analog Models:

- **R4FXO-EC:** Quad FXO Channels with Echo Cancellation
- **R24FXS-EC:** 24 port FXS Channels with Echo Cancellation
- **R24FXO-EC:** 24 port FXO Channels with Echo Cancellation

Modular Analog Models:

- **R8FXX:** Modular Octal FXS/FXO with Echo Cancellation
- **R24FXX:** Modular 24 FXS/FXO with Echo Cancellation

Daughter cards:

- **DFXS:** Dual FXS Module
- **DFXO:** Dual FXO Module

Rhino Equipment Corp. is proud to manufacture our products in the U.S.A.

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Managing your open source telecommunication needs has never been easier than with Rhino products. Rhino PCI plug-in cards satisfy the needs of Open Source Telephony (OST) applications, no matter how stringent the requirement. Rhino Open Source Telephony PCI cards feature Asterisk* and Linux tested software. Knowing that Rhino products are ready to perform right out of the box means that you can spend more time developing important customer relationships.

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Rhino designed products are tough. In the rare case of trouble, our technical support staff is ready to give you the support you need, when you need it. Our 5-year, limited warranty means that you can be confident that Rhino will always work in your Open Source Telephony application.

* Asterisk is a registered trademark of Digium.

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Version 2, June 1991

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User Information for FCC Part 68

Products: R1T1, R1T1-e, R2T1, R3T1-e, R4T1, R4T1-e, R4FXO, R8FXX, R24FXX, R24FXS, and R24FXO models

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. On the bottom of this equipment is a label that contains, among other information, a product identifier in the format US: AAAEQ##TXXXX (where "X's" are shown will represent product number, for example R1T1). If requested, this number must be provided to the telephone company. This equipment uses the standard RJ11C, RJ21 or RJ-48C jack types for network connection.

A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. A compliant telephone cord and modular plug is provided with this product. It is designed to be connected to a compatible modular jack that is also compliant. See installation instructions for details.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, for repair or warranty information, please contact Rhino Equipment Corp, 8240 S. Kyrene Road, Suite 107, Tempe, AZ 85284. Tel: 800.785.7073. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.
Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.
If your home has specially wired alarm equipment connected to the telephone line, ensure the installation of this equipment does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.

User Information for FCC Part 15

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS:
1(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
2(2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE, RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE:

RHINO EQUIPMENT CORP. IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

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1. PREINSTALLATION

Rhino OST PCI cards are easy to setup and use, which will make your telephony life easier! Please spend a few minutes reviewing these instructions to ensure a successful installation.

1.a Warranty

Rhino OST PCI cards are covered by a 5-year limited factory warranty. The warranty statement is available on the Rhino web site, the Rhino CD-ROM, the Rhino Public FTP, or by request.

Please note that damage caused by improper installation or acts of nature are not covered by this warranty.

1.b Standards

This equipment complies with Part 68 of the FCC Rules. The number is located on the back of the Rhino OST PCI Card. The label contains the FCC Registration Number for this equipment. If requested, this information must be presented to your telephone company.

Connection to the telephone network should be made by using standard modular network jacks, type RJ45. The plug and/or jacks used must comply with FCC Part 68 Rules.

OPERATION	FIC	SOC	(USOC) JACK
T1 CSU Interface	04DU9-BN	6.0N	RJ48C
	04DU9-DN		
	04DU9-1KN		
	04DU9-1SN		

If this telephone equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance in order for you to make necessary modifications to maintain uninterrupted service. If trouble is experienced with this unit, please contact customer service at the address and phone listed below. DO NOT DISASSEMBLE THIS EQUIPMENT. It does not contain any user serviceable components.

1.c Surge Protection

It is recommended that a surge protector or uninterruptible power supply (UPS) be installed in conjunction with the PC that the Rhino OST PCI card is installed in. This will help minimize damage as a result of lightning strikes and other AC line surges. Failure to use a UPS could affect the 5 year limited warranty.

2. INSTALLATION

2.a Site Selection

The selected installation site should provide a stable operating environment. The area around the installation site should be clean and free from extremes of temperature, humidity, shock, and vibration. The operating temperature should be kept below 100 degrees F (38° C).

The Rhino OST PCI card is designed to be used on T1/DS1/ISDN-PRI/E1 services for a T1 card, or to be connected to the PSTN when using and analog card. Connecting it to any other type of telecommunications service or services will void the warranty and could cause damage to the network of the provider of the non-approved service or services.

All wiring done external to the Rhino OST PCI card should follow the guidelines as set forth by the National Electrical Code. See section 1.b and 3.a.

2.b Unpacking the Rhino PCI Card

The unit comes tested and sealed in an anti-static custom shipping box. The package contains the Rhino OST PCI card Users Manual, and a Rhino Products CD containing the most recent drivers and documentation.

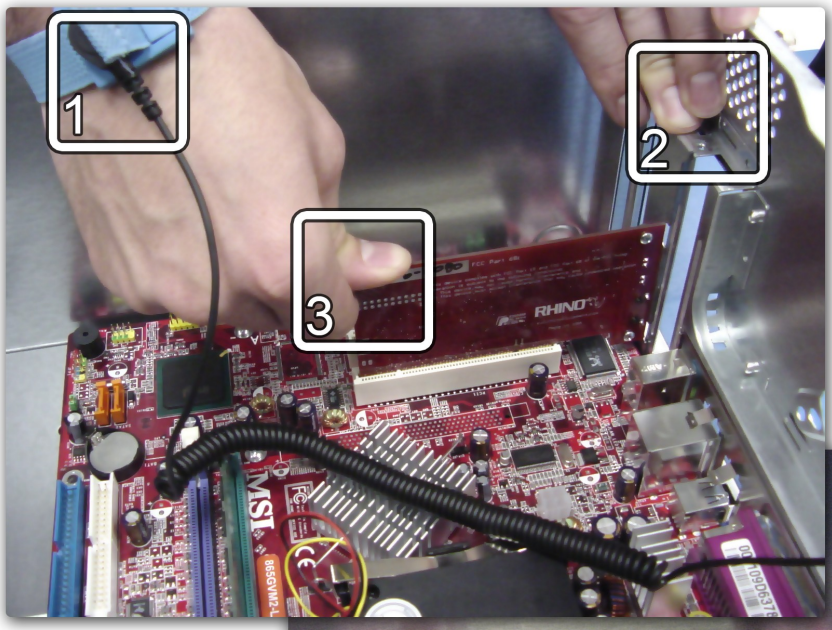
Before removing the card from its packaging, ensure that you are grounded.
To ground yourself please use an Anti-Static wrist band.

Inspect the Rhino OST PCI card for any signs of physical damage. Report any damages to the shipper. Keep all packaging material in the event that you need to move or ship the unit. Warranty returns must be shipped back to Rhino Equipment Corp in the original shipping box.

2.c Physical Installation

Before removing the card from its packaging, ensure that you are grounded.
To ground yourself please use an Anti-Static wrist band.

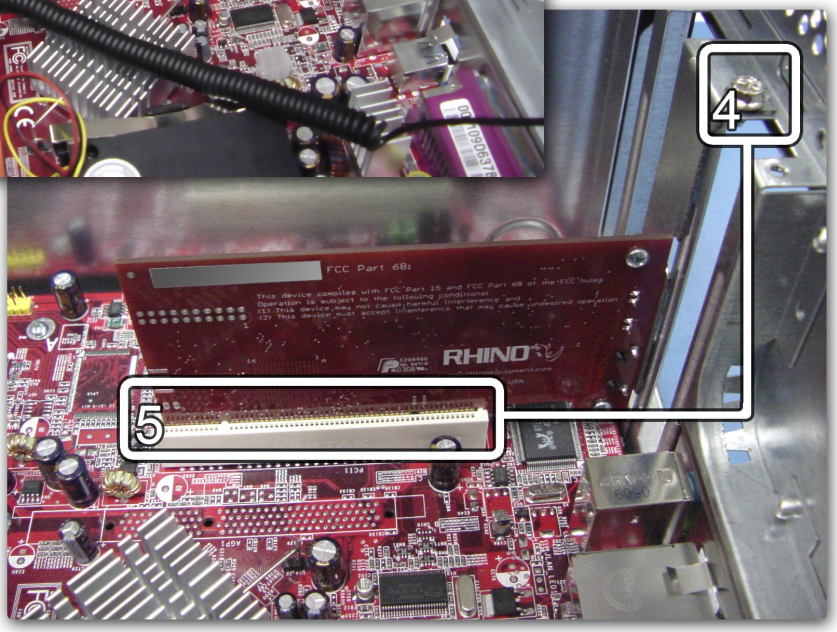
While removing the Rhino OST PCI card take care to only handle the mounting bracket, avoid making contact with any of the PCI card circuitry. The Rhino OST PCI card is intended to be installed in an ATX form factor motherboard, the chassis housing the Rhino OST PCI card should also be an ATX form factor chassis. Failure to install the Rhino OST PCI card in this configuration will affect the warranty of your Rhino product(s).



1. Please make sure that you are fully grounded before handeling the PCI card.

2. Avoid making contact with the PCI cards electrical components.

3. Make sure that the PCI card is properly seated in the PCI slot.



4. Fasten the PCI card bracket to the PC chassis to help ensure proper grounding and stability.

5. Please double check that the PCI card is properly seated before powering on the PC.

Fig 1.

3. INSTALLATION FOR T1 OST CARDS

3.a Connecting the Rhino T1 Card to T1/E1/PRI

The Rhino OST T1 cards (DS1) interface is an industry-standard RJ48C eight pin connector with its connections described below. The T1 is usually connected to a Rhino CB24 channel bank or the telecommunications carrier demarcation point. If the T1 is coming from a Rhino CB24 channel bank, the T1 cable must be a crossover T1 cable.

Figure 2 shows the pin out for building a T1 crossover cable. This cable can be used to connect two T1 CSU/DSU (i.e. TSU) products in a point-to-point configuration.

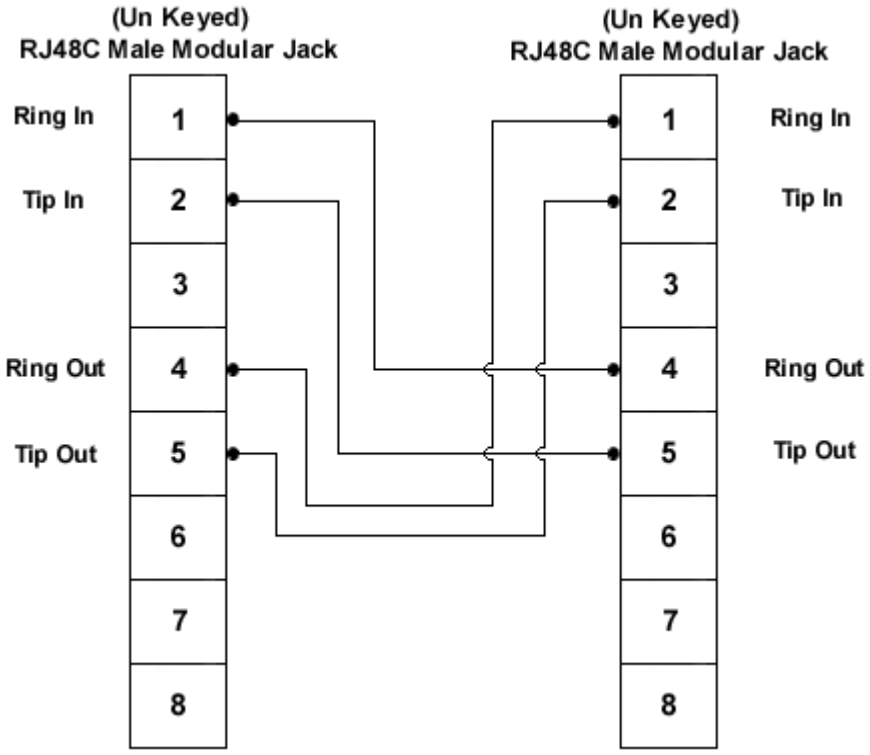


Fig 2.

If the T1 is coming from the demarcation point please use a straight thru T1 cable to connect to the Rhino OST T1 card. In some cases additional cable must be run from the carrier's demarcation point to the customer's suite or nearby "phone room".
T1 Line Interface on RJ45 - 8 pin Modular T1 jack

Pin Number	Signal	To/From What?
1	Receive Ring	Coming From T1 (Network)
2	Receive Tip	Coming From T1 (Network)
3	Not connected	
4	Transmit Ring	Going To T1 (Network)
5	Transmit Tip	Going To T1 (Network)
6	Not connected	
7	Not connected	
8	Not connected	

The maximum cable length for a T1 Network (DS1-1) connection is suggested as follows. Reliable T1 cabling distances depend on which type of cable is used. It is strongly recommended that only shielded cable be used as part of any T1 installation. For best results use: shielded 22 AWG T1 cable (ABAM 600).

ABAM 600 T1 Cable
T1 Network (CSU) can go as far as 6,000 feet

ABAM 600 Cable Specifications:

Nominal Impedance:	100 ohms +/- 5% at 772 kHz.
Insertion Loss:	Better than 7 dB per 1,000 feet at 1.544 MHz. Better than 5 dB per 1,000 feet at 772 kHz.
Far-End Crosstalk:	Better than 85 dB per 1,000 feet at 1.544 MHz. Better than 90 dB per 1,000 feet at 772 kHz.
Near-End Crosstalk:	Better than 80 dB per 1,000 feet at 1.544 MHz. Better than 85 dB per 1,000 feet at 772 kHz.
Shields:	Transmit and receive pairs are individually shielded with aluminum/polyester tape.

If you used unshielded cable you could experience problems. When this type of cable is used, transmit and receive pairs are usually run in separate cables to avoid crosstalk which often occurs in unshielded cables. Failure to use separate cable bundles for transmit and receive can result in the CSU LINE port clocking onto itself (due to crosstalk) with as little as 10 feet of un-terminated (unshielded) telephone cable attached. The CSU can thus show a normal framed status when the far end of the telephone wiring is actually disconnected. Again, this is due to crosstalk between pairs in the same cable bundle. This is true of any CSU installation using any kind of unshielded twisted pair cable.

3.b Hardware Configuration

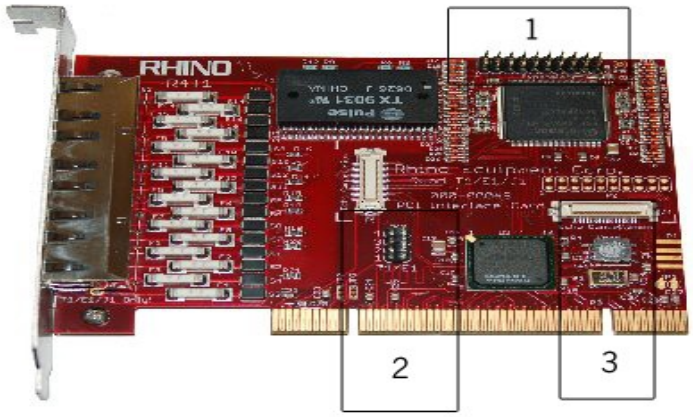


Fig 3

Normally, no other configuration is necessary to get a Rhino digital telephony card to operate in a system. In cases where multiple cards are used within the same system, or mixed E1 and T1 modes are needed on the same card, additional configuration may be necessary.

Timing Cable
A special 20 pin ribbon cable can be used to connect multiple Rhino digital telephony cards to provide a common clocking source to all spans. In Fig. 3, box 1 shows the location of the Timing cable connector. Obtain this cable direct from Rhino by contacting Technical Support. Please note that special command line options must be provided when loading the module to allow for this option to operate as planned.

T1/E1 Span Selector
In cases where all cards of the same type are not configured the same; or when enabling E1 (T1 is the default configuration). The span selector pin header can be used to select the desired mode for each span. In Fig. 3, box 2, the span type selection can be made by installing a shorting midgie across the span where E1 is desired. There are two options for this situation:

NOTE: r1t1 is the module for the Rhino R1T1 PCI Cards. The rxt1 module is for the R2T1 and R4T1 Cards.

By using insmod, or putting the parameter in modprobe.conf (or a file in the directory /etc/modules.d/ depending on the distribution). Bit 0 of xx is a 0 to configure span 1 as a T1 or a 1 to configure span 1 as E1. Bit 1 configures span2 etc. Example: t1e1 = 3 configures span 1 as E1, span 2 as E1, span 3 as T1, and span 4 as T1. All installed cards will have the same configuration. The line looks like:

insmod rxt1.ko t1=xx

To make your Rhino T1 to a Rhino E1:

R1T1 E1 configuration:
insmod /lib/modules/`uname -r`/extra/r1t1.ko e1=1 (OR e1t1override=1)

R2T1 and R4T1 E1 Configuration:

insmod /lib/modules/`uname -r`/extra/rxt1.ko t1e1override=15
(if this does not work try: **insmod /lib/modules/`uname -r`/extra/rxt1.ko e1=15**)

Load Identifier (Module Instance Load order)
Normally Linux loads PCI devices in the order that they are found on the PCI bus, most likely from the PCI slot closest to the CPU on the motherboard, and outward from that position. For a digital telephony card, slot 1 would become the first span loaded, and would default to Span 1 in all configurations. The Load rotary switch allows for alternate loading of the position of the PCI card, and allows for spans to be loaded in a different order than how the cards are located in the motherboard.

3.c Generic Instructions for Installing ALL Rhino PCI cards. OS and Zaptel agnostic.

Note: TRIXBOX 2.2 users. Please follow the directions at the end of the installation section.

Note: The Rhino drivers (module) are only compatible with the Linux kernel 2.6.9 and higher. Please make sure this is installed and the Rhino OST PCI card is properly installed before continuing with the software configuration.

1. Boot the PC and log in as "root" or other user that has appropriate software build privileges.

2. Navigate to the Zaptel source directory. This is normally located in: **"/usr/src/zaptel"**. If the Zaptel source is not present, you will need to download that using the next sections. If the Zaptel directory is already present, you may jump to number 10 below.

Note: The zaptel source directory can be anywhere on your hard drive, you will need to locate where you installed zaptel if the above example does not work for you. However if the zaptel directory is anything other than "/usr/src/zaptel" then create a link that points to the actual Zaptel source directory.

Zaptel Source Installation Notes (only if needed, these optional steps are shown with a >x below, items 3 through 9 below):

Note: For Trixbox 2.x users the Zaptel source and kernel-headers must be downloaded. If you are using Trixbox 2.x you need to download the Zaptel source, and recompile Zaptel. In the "/usr/src" directory (**cd /usr/src**) please install zaptel:

>3. Download the Zaptel source, making sure that you are in the /usr/src directory:

wget ftp.digium.com/pub/telephony/zaptel/releases/zaptel-version.number.tar.gz

>4. Decompress the downloaded tarball

tar -xzvf zaptel-version.number.tar.gz

>5. Create a symbolic link to zaptel:

ln -s /usr/src/zaptel-version.number.tar.gz /usr/src/zaptel

>6. Change your present working directory to /usr/src/zaptel

cd /usr/src/zaptel

>9. Compile Zaptel

make && make install

10. In the **"/usr/src/"** directory please do the following ONLY IF your zaptel directory is different than "**/usr/src/zaptel**":

ln -s /usr/src/zaptel-xxx /usr/src/zaptel
(where"/usr/src/zaptel-xxx" is the path of your installed zaptel directory.)

11. Download the Rhino drivers in a single package:

wget ftp://ftp.rhinoequipment.com/Drivers/rhino-version-#.tbz2

12. Extract the .tbz2 file to its own directory

tar -xjvf rhino-version-#.tbz2

13. Next change the directory into the Rhino Driver Directory, and run "make" as follows:

make && make install
(This will make *and* install the Rhino drivers independently of Zaptel and Asterisk. You may optionally use make, then make install to perform this in two separate command line sessions)

14. Next type the following command in the prompt to update the driver database:

depmod

15. Now load your module. Depending on your card(s) type one of the following commands.

For R4FXO rev A and B type:
modprobe r4fxo

For R4FXO rev C, R8FXX, R24FXX, R24FXS, and R24FXO type:
modprobe rcbfx

For R1T1 type:
modprobe r1t1

For R2T1, and R4T1 type:
modprobe rxt1

16. Move on to configuring the zaptel interface. For more information on span and channel configuration please refer to sections 3.d & 3.e. For configuration examples for Rhino analog PCI cards please refer to section 4.c

For TrixBox Specific Installations:

1. Boot the PC and log in as “root” or other user that has appropriate software build privileges.

2. Install the Rhino RPM's:
   yum -y install rhino-`uname -r`
   press ENTER

3. reboot

Note: genzaptelconf ONLY works in Trixbox 2.2 and later.

4. Type the following for analog cards:
   genzaptelconf
   For Digital Cards please skip to configuring zaptel.conf and zapata.conf

3.d Rhino OST T1/E1 PCI card Port and Span configurations

The first lines of the zaptel configuration file (comments excluded) will be the span definitions for T1/E1 interfaces.

A span definition is in this format:

span=(spannum),(timing),(LBO),(framing),(coding)

(see next page for more examples)

Spannum:

Spannum defines the number assigned to the span these definitions apply to. If you only have one R1T1 card installed you will only have one span (span 1), if there are two single port R1T1 cards installed you will have two spans (span 1 corresponds to the first port on the first module loaded). For an example of span numbering please refer to figure 3.

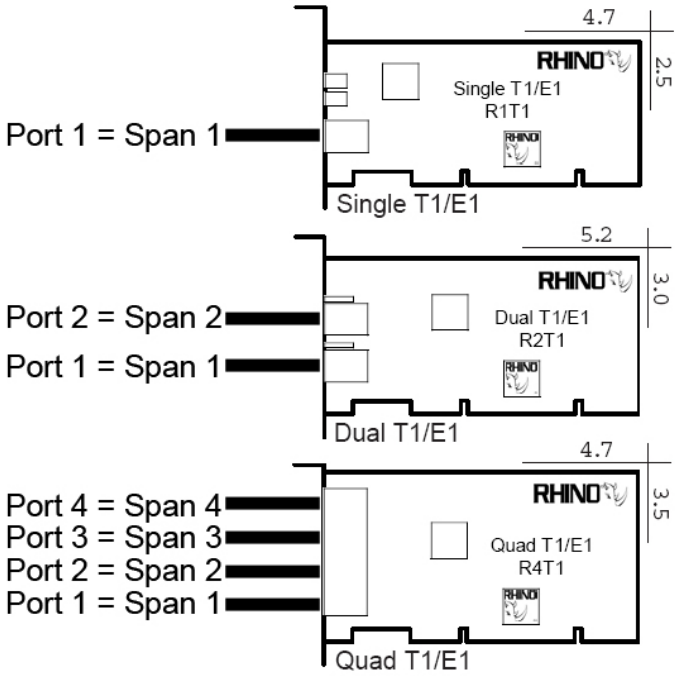


Fig 4. (dimensions in inches)

Timing:

Use '1' if you want to use the circuit as your primary timing source. If '0' is used Asterisk will try to provide timing to the span (if you were connecting to a Rhino CB24 this would be correct.). If Asterisk is connected directly to the telco you will want to use '1' to accept timing from them. If you have multiple spans; set the timing accordingly such as 2, 3, 4, etc.

0: to not use this span as sync source
1: to use as primary sync source
2: to set as secondary and so forth

Tip: Problems with timing manifest themselves in different ways - with static, pops, and channels or calls regularly dropping.

LBO:

Line Build Out (LBO) is taken from the table below.
0: 0 db (CSU) / 0-133 feet (DSX-1)
1: 133-266 feet (DSX-1)
2: 266-399 feet (DSX-1)
3: 399-533 feet (DSX-1)
4: 533-655 feet (DSX-1)
5: -7.5db (CSU)
6: -15db (CSU)
7: -22.5db (CSU)

Framing:

For T1 - Framing is either d4 or esf. Coding is either ami or b8zs.

For E1 – Framing is either cas or ccs. Coding is either ami or hdb3. E1's spans may also need to enable crc checking.

T1 span configuration used to connect to a Rhino CB24:
span=1,0,0,esf,b8zs

A common E1 span configuration:
span=1,0,0,cas,ami,crc4
Leave off the ',crc4' if crc checking should not be enabled.

3.e Rhino OST T1/E1 PCI card Channel configurations

Rule of Thumb: Have you ever heard someone say "Opposites attract"? The same is true when configuring zaptel and Zapata for your Rhino OST PCI card. When configuring the signaling for your interface channels remember that physical FXO channels require FXS signaling and physical FXS channels require FXO signaling.

When you are configuring your Rhino OST PCI T1 card to work with a Rhino CB24 please use the following signaling:

(CB24-FXO) signaling = fxsks(zaptel.conf) fxs_ks(zapata.conf)
(CB24-FXS) signaling = fxols(zaptel.conf) fxo_ls(zapata.conf)
For CB24-MOD signaling see the example below

zaptel.conf
;Span 1
span=1,0,0,esf,b8zs
; First 4 channels are the FXO modular card
fxsks=1-4
; Next 16 channels are the 4 modular FXS cards
fxols=5-20
zapata.conf
;First 4 channels are the FXO modular card
signalling = fxs_ks
channel => 1-4
;Next 16 channels are the 4 modular FXS cards
signalling = fxo_ks
channel => 5-20

Once zaptel.conf and zapata.conf are configured, initialize the card with the new configuration values by running **"ztcfg"** from the Linux command prompt.

Tip: After configuring the signaling for your Rhino OST PCI card, start Asterisk in a terminal, then simply run "Auto T1" on your Rhino CB24 or manually configure it with LOOP signaling ESF framing and B8ZS coding.

3.f Rhino OST T1/E1 PCI card LED Status Codes

Below is a chart for LED state code for all Rhino OST PCI T1/E1 cards:

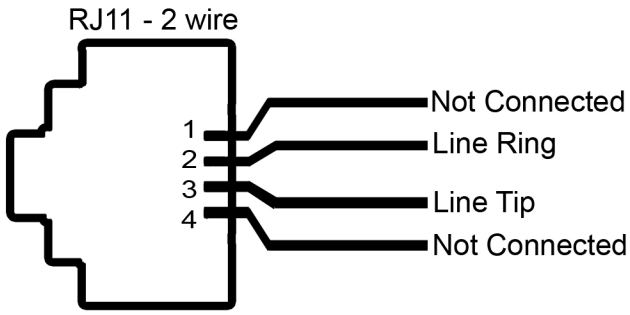
	GREEN	RED	STATE
Hardware			
	On	On	Self Power Check
	On	2 Fast	PCI Slot Recognition
	On	4 Fast	Registering PCI Card With BIOS
	2 Fast	4 Fast	Loading Firmware Module
	2 Fast	Off	Synchronizing With System Bus
Software			
	Off	Off	No Cable Link Detected
	Off	On	Invalid Carrier Signal
	2 Fade	On	Module Loaded But Not configured
	On	Off	Normal Operation
	2 Fade	2 Fade	Yellow Alarm, Down Stream Sending Error Signal
	2 Fade	4 Fast	Sending Loop Back Signal
	4 Fast	2 Fade	Receiving Loop Back Signal
	4 Fast	4 Fast	Recovering

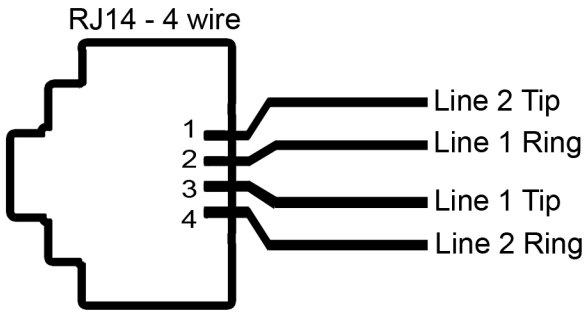
Note: You will see most blink codes on a normal boot up, however if the card halts at any state this could indicate a problem.

4. INSTALLATION FOR Rhino OST Analog CARDS

4.a Connecting Rhino Analog cards to telco/extensions.

The Rhino OST PCI analog cards use an industry standard RJ11 four pin plug for the R4FXO quad port FXO card, with pin lay out shown below. And an industry standard RJ14 four pin plug for all octal modular cards (R8FXX), pin lay out is also shown below.





Phone Line Interface on RJ11 - 4 pin Modular jack:

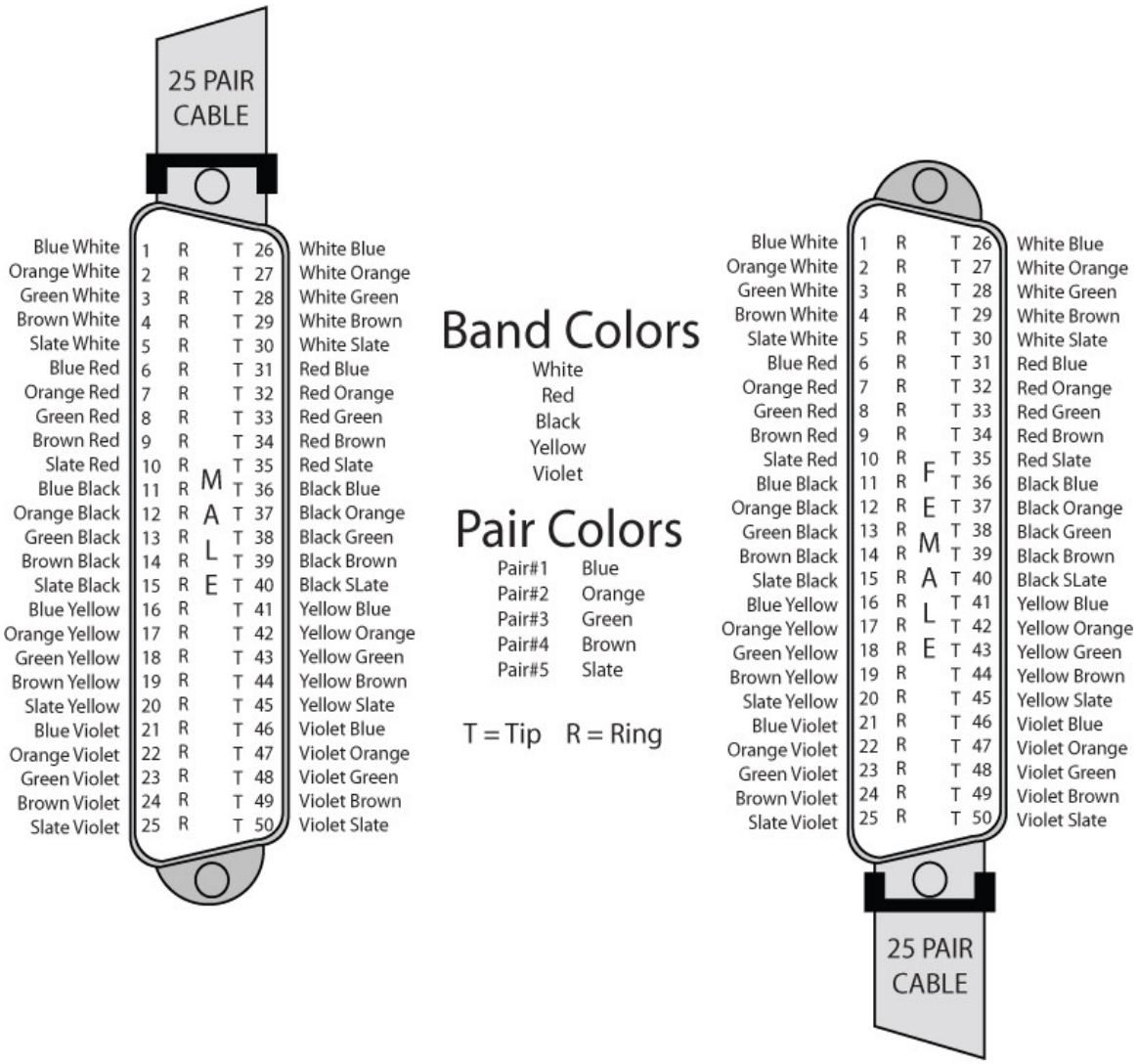
Pin Number	Signal	To/From What?
1	Not connected	
2	Line Ring	RX Coming From PSTN (CO)
3	Line Tip	TX Going to PSTN (CO)
4	Not connected	

Phone Line Interface on RJ14 - 4 pin Modular jack:

Pin Number	Signal	To/From What?
1	Line 2 Tip	TX Going to PSTN (CO)
2	Line 1 Ring	RX Coming From PSTN (CO)
3	Line 1 Tip	TX Going to PSTN (CO)
4	Line 2 Ring	RX Coming From PSTN (CO)

The 24 FXS channel (R24FXS) and modular 24 channel Rhino OST PCI (R24XX) analog cards uses an industry standard RJ21 connection, shown below.

RJ21X Standard Telco Cable Pinout


25 PAIR CABLE
Blue White 1 R T 26 White Blue
Orange White 2 R T 27 White Orange
Green White 3 R T 28 White Green
Brown White 4 R T 29 White Brown
Slate White 5 R T 30 White Slate
Blue Red 6 R T 31 Red Blue
Orange Red 7 R T 32 Red Orange
Green Red 8 R T 33 Red Green
Brown Red 9 R T 34 Red Brown
Slate Red 10 R T 35 Red Slate
Blue Black 11 R T 36 Black Blue
Orange Black 12 R T 37 Black Orange
Green Black 13 R T 38 Black Green
Brown Black 14 R T 39 Black Brown
Slate Black 15 R T 40 Black SLate
Blue Yellow 16 R T 41 Yellow Blue
Orange Yellow 17 R T 42 Yellow Orange
Green Yellow 18 R T 43 Yellow Green
Brown Yellow 19 R T 44 Yellow Brown
Slate Yellow 20 R T 45 Yellow Slate
Blue Violet 21 R T 46 Violet Blue
Orange Violet 22 R T 47 Violet Orange
Green Violet 23 R T 48 Violet Green
Brown Violet 24 R T 49 Violet Brown
Slate Violet 25 R T 50 Violet Slate
MALE
Band Colors
White
Red
Black
Yellow
Violet
Pair Colors
Pair#1 Blue
Pair#2 Orange
Pair#3 Green
Pair#4 Brown
Pair#5 Slate
T = Tip R = Ring
Blue White 1 R T 26 White Blue
Orange White 2 R T 27 White Orange
Green White 3 R T 28 White Green
Brown White 4 R T 29 White Brown
Slate White 5 R T 30 White Slate
Blue Red 6 R T 31 Red Blue
Orange Red 7 R T 32 Red Orange
Green Red 8 R T 33 Red Green
Brown Red 9 R T 34 Red Brown
Slate Red 10 R T 35 Red Slate
Blue Black 11 R T 36 Black Blue
Orange Black 12 R T 37 Black Orange
Green Black 13 R T 38 Black Green
Brown Black 14 R T 39 Black Brown
Slate Black 15 R T 40 Black SLate
Blue Yellow 16 R T 41 Yellow Blue
Orange Yellow 17 R T 42 Yellow Orange
Green Yellow 18 R T 43 Yellow Green
Brown Yellow 19 R T 44 Yellow Brown
Slate Yellow 20 R T 45 Yellow Slate
Blue Violet 21 R T 46 Violet Blue
Orange Violet 22 R T 47 Violet Orange
Green Violet 23 R T 48 Violet Green
Brown Violet 24 R T 49 Violet Brown
Slate Violet 25 R T 50 Violet Slate
FEMALE
25 PAIR CABLE

4.c Rhino OST PCI Analog card Channel configurations

Rule of Thumb: Have you ever heard someone say "Opposites attract"? The same is true when configuring Zaptel and Zapata for your Rhino OST PCI card. When configuring the signaling for your interface channels remember that physical FXO channels require FXS signaling and physical FXS channels require FXO signaling.

Rhino analog cards like LOOP and KEWL start signaling, so be sure to use just these two signaling choices in your Zaptel and Zapata configuration files!

When you are configuring your Rhino OST PCI analog card with only FXO channels use the following signaling:

zaptel.conf
; First 4 channels are the R4FXO card
fxsks=1-4
; Next 4 channels are the R8FXX card with two dual FXO modules installed
fxsks=5-8
;Next 4 channels are the R8FXX card with two dual FXS modules installed
fxols=9-12

zapata.conf
echocancel=yes (this must be specified for enabling the hardware Echo Cancellation)
; First 4 channels are the R4FXO card
signalling = fxs_ks
channel => 1-4
; Next 4 channels are the R8FXX card with two dual FXO modules installed
signalling = fxs_ks
channel => 5-8
; Next 4 channels are the R8FXX card with two dual FXO modules installed
signalling = fxo_ls
channel => 9-12

Important: Once zaptel.conf and zapata.conf are configured, initialize the card with the new configuration values by running **"ztcfg -vvv"** from the Linux command prompt. This will force zaptel to read your configuration files, and if there are errors, they will be reported. Errors must be fixed before continuing or zaptel will not identify the channels correctly.

4.e Rhino Firmware File Update

If a new firmware file update becomes available, be sure to install that firmware file into the proper location. For example, for Rhino analog cards, the rcbfx.fw file must be installed into the /lib/firmware directory using:

install -m 644 rcbfx.fw /lib/firmware

This assures that the firmware file will be updated the next time the Rhino module is loaded, which normally happens when the PC boots. You can manually force this event using:

rmmod rcbfx
modprobe rcbfx

or to force the uploading of the any version of firmware to the rcbfx analog card, which is the last version that was “installed” using the install command:

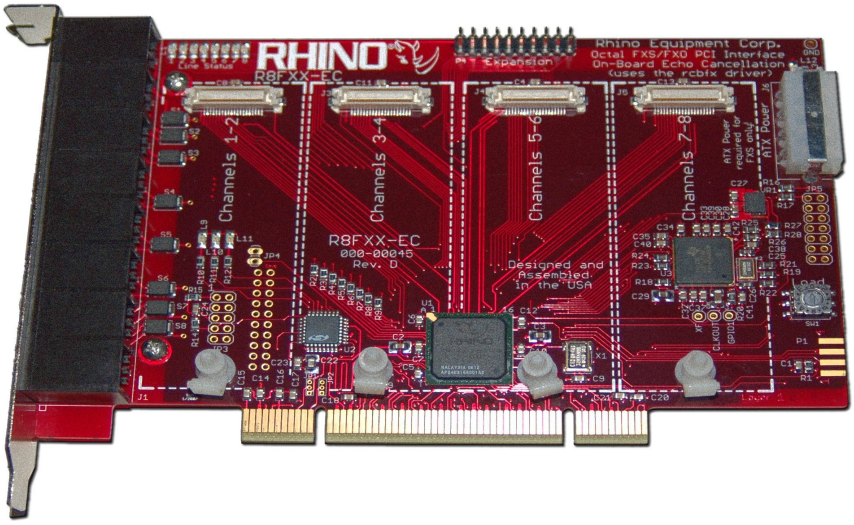
rmmod rcbfx
insmod /lib/modules/`uname -r`/extra/rcbfx.ko force_fw=1

You can use

dmesg | grep rcbfx

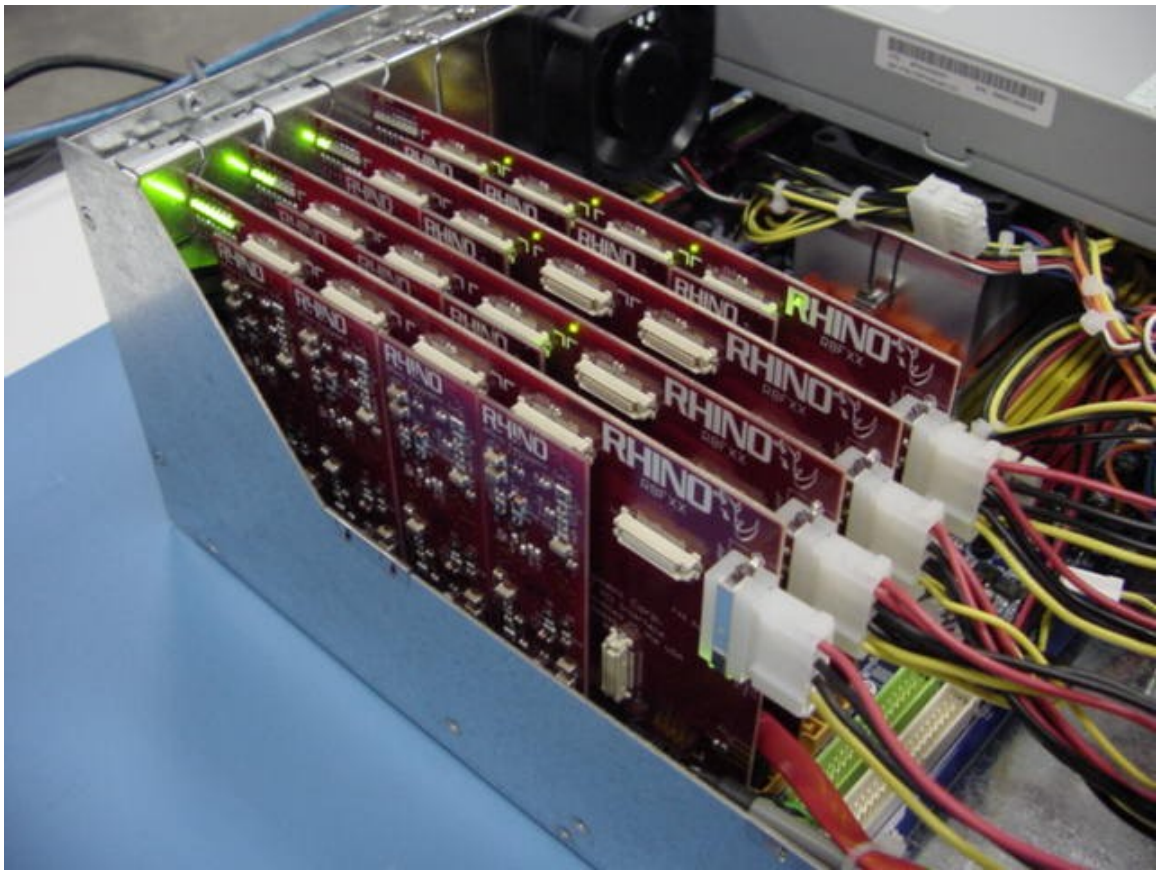
to view the status of the module loading, and to validate the hardware, firmware and DSP version installed as well once the module has loaded.

4.f Connecting Power to the Rhino R8FXX, R24FXX, and R24FXS Analog card installations



Remember that the Rhino R8FXX card has only four physical connections on the back of the card, and eight total analog line connections. This is accomplished by using BOTH of the wire connections on a RJ11 plug. The center two pins are line 1, and the outside two pins are line 2, on the top or first jack. Look on the back of the card to identify the channels: 1-2 are on the top, and 7-8 are on the bottom.

Note that both the R8FXX, R24FXX, and the R24FXS cards require +12V power to give the FXS channel its juice. Be sure to connect a power supply ATX connector to the rear of the card if that is the case. Also note that it is not necessary to connect this power if there are no FXS channels connected, as in a R8FXX with all FXO modules, a R24FXX with all FXO modules, or the R24FXO card.



There are two locations to look for FXS power indication. A board level power indicator is located at the connector end, and is a green LED. Each FXS board also has a single LED that can be seen off the reflection of the main board, at the top of the card.

4.g Rhino R4FXO (Rev. C and higher) and R8FXX LED Codes

There are eight status LEDs located on the top right of the R8FXX board that depicts channel status.

	GREEN	**STATE**
LED		
	Off	Line not in use
	On	Line in use
	Rapid Flash	Line ringing
	Slow Flash	Line is in the process of being connected
	Ramp On/Off	FXO line does not see battery

You can also use zttool to show the raw signaling data.

There are also two master LED modes, when the computer boots and before the PCI side configures, all of the eight LEDs should be on solid. Once the PC boots and the card is detected, a “night rider” display will engage. Once the module is loaded (rcbfx), the LEDs will then start to indicate status as per the above table.

5.0 Rhino FTP Site

Please note that Rhino Equipment Corp. maintains a FTP site where all of the latest information is always available.

ftp.rhinoequipment.com

All rhino card drivers are provided within one installation package. When navigating to the Rhino FTP site, click on drivers and locate the updated package that you wish to install.

It is simple to update your local copy of any Rhino driver by using wget, like this:

wget ftp://ftp.rhinoequipment.com/Drivers/rhino-version.#.tbz2

If you are updating your drivers, it is safest to rename the current Rhino directory to a backup directory. Then pull the new drivers to a clean Rhino directory directory. Use the move (**mv**) command to do this.

mv Current-Rhino-driver* Rhino-driver_backup

This renames the current Rhino directory to a new directory called Rhino-driver_backup, and all of the files contained in that directory. Now you can pull the new files from the Rhino ftp site and still have a copy of the old source driver files.

6.0 Useful Linux-Asterisk Commands (for CentOS, RedHat, and Fedora based systems)

Commands from the Linux command line

Tab key	use this to "auto complete" command line entries, very useful!
uname –r	displays the kernel version
cat /proc/zaptel/*	shows the installed zaptel compatible cards and channels
modinfo "driver name"	shows information about the associated linux driver
modprobe "driver name"	load a module, in this case the rcbfx module, using the rules in /etc/modprobe.conf (i.e. used to load the module AND rm a ztcfg)
insmod driver.ko	load a module, all by itself. This is particularly useful when a module has command line options, use modinfo to see those
rmmod "driver name"	unload a module, in this case the rcbfx module
lsmod	shows the installed linux modules, sometimes if the list is long using grep to isolate the zaptel associated entries with **lsmod | grep zaptel** display's only the zaptel and zaptel dependent modules
lspci	shows the PCI cards installed
cat /proc/interrupts	shows how the interrupts in a linux system are routed
ztcfg –vvv	forces zaptel to read zaptel.conf, and to associate entries there with the module interface with a verbose display
zttool	show the zaptel compatible cards, their overall status, and if selecting a card, its individual status and signaling states
amportal	a freePBX specific command to start, stop, and restart asterisk and freePBX dependencies. (i.e. **amportal start**, or **amprotal restart**)
udevstart	restarts the module handling utility, normally this starts on boot
Asterisk Console (CLI)	asterisk -r

Commands to use from the Asterisk CLI

zap show channels –	shows the installed zap channels, this should mirror the zapata.conf channel configuration
extensions reload –	used to load changes made to any dial plan file without having to restart Asterisk
service zaptel restart –	reloads the zaptel modules and dependencies.
View Current Process Load	top
Interrupt Information (IRQ)	cat /proc/interrupts
RAID Array Information	cat /proc/mdstat
Checking CPU Information	cat /proc/interrupts
Checking Memory Information	cat /proc/meminfo
Intensive Performance Information	vmstat 1
Current system processes	ps -aux
Current Networking Information	ifconfig -a
SCP Usage	scp /file/to/transfer <remote_host>:/where/to/transfer
Checking Disk Space	df -h

TrixBox Specific

StoppingAsterisk	amportal stop
Starting Asterisk	amportal start
Display TrixBox help options	help-trixbox
Zaptel Card Status	zttool
Detailed PCI Card Status	ztcfg -vvv
Analog Auto config	genzaptelconf (**TrixBox 2.2 and above ONLY**)

Set master password for GUI	passwd-maint
Set password for amp only	passwd-amp
Set password for Web MeetMe only	passwd-meetme
Set root password for console login	passwd root
Set admin password for checking system mail	passwd admin
Create a SIPDefault.cnf in /tftpboot	setup-cisco
Create a aastra.cfg in /tftpboot	setup-aastra
Setup for autoconfiguration of Grandstream	setup-grandstream
Set up a dhcp server	setup-dhcp
Set up a Samba server (Microsoft file sharing)	setup-samba
Configure sendmail	setup-mail

Telephone Function Shortcuts

User Logon	*11
User Logoff	*12
ZapBarge	888
Simulate Incoming Call	7777
Call Forward All Activate	*72
Call Forward All Deactivate	*73
Call Forward All Prompting Deactivate	*74

Call Forward Busy Activate	*90
Call Forward Busy Deactivate	*91
Call Forward Busy Prompting Deactivate	*92
Call Forward No Answer/Unavailable Activate	*52
Call Forward No Answer/Unavailable Deactivate	*53
Call Waiting - Activate	*70
Call Waiting - Deactivate	*71
DND Activate	*78
DND Deactivate	*79
My Voicemail	*97
Dial Voicemail	*98
Save Recording	*77
Check Recording	*99
Directory	#
Call Trace	*69
Echo Test	*43
Speaking Clock	*60
Speak Your Exten Number	*65
ChanSpy	555
Intercom Prefix	*80

Contact: Rhino Equipment Corp.
Attn: CUSTOMER SERVICE DEPT.
8240 S. Kyrene Rd. Suite 107
Tempe, AZ 85284
Ph 480-940-1826, Fax 480-961-1826
Email support@rhinoequipment.com
Phone (480) 940-1826 or (800) 785-7073

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